

Chapter 57

Sustainable Implications of Industry 4.0

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ABSTRACT

Industry 4.0, and in general, digital technologies, represent a fundamental model shift towards decentralization and individualized production. With this, the development of new services and business models based on the internet is encouraged. Somehow, this forces traditional supply chains to evolve into highly adaptative networks. Companies have to consider their internal resources and the benefits of getting closer to partners in the supply chain. In this sense, the implementation of these technologies is accompanied by a series of sustainable implication at economic, environmental, and social levels.

1. INTRODUCTION

Recent changes in technological and international issues have heightened the need for companies to keep abreast of their competition and, in general, of what disturbs their stability (Ngai et al., 2011; Sanders, 2007). This situation has accelerated the pace of innovation concerning its discovery, implementation, introduction, and diffusion into the market. This issue has grown in importance in light of the recent emergence of digital technologies associated with the concept of Industry 4.0. In general, it represents a fundamental model shift towards decentralization and individualized production (Lasi et al., 2014; Linkov et al., 2018). This shift mainly encourages the development of new services and business models based on the Internet, which somehow forces traditional supply chains to evolve into highly adaptative networks (Duarte and Cruz-Machado, 2018). Many companies have already taken the first steps towards a connected industry. However, the road to a positive development goes through a process of evolution rather than a revolution. Alongside this evolution, companies have to consider sustainability to remain competitive and also follow the current trend.

The concept of sustainability refers to the maintenance of the well-being over a long period, which inherently implies people, planet and profit (Elkington, 1994; Kuhlman and Farrington, 2010). Companies have to manage the resources needed for production, knowing that those essential today may be

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substituted by others tomorrow (Kuhlman and Farrington, 2010). The main objectives of sustainability should include the reduction of inequalities, decent work, and responsible consumption and production (Linkov et al., 2018). In this sense, sustainability should be considered as the central focus to guarantee both the resources needed and the impact on future generations.

The relationship between humankind and nature comprises two opposing views, one that stresses adaptation and harmony, and another that sees nature as something to be conquered (Kuhlman and Farrington, 2010). Thus, companies have to deal with fundamental decisions. On the one hand, companies have to develop their strategy and find the position they feel most comfortable with under one of these perspectives. On the other hand, it is unknown whether digital technologies will be able to offer solutions in the future. Hence, companies must take advantage of their current benefits to manage the resources that are more appealing to them in the best possible conditions. In sum, if companies make the proper choice and follow the right guidelines, they will obtain benefits from the implementation and development of digital technologies.

The arrival of Industry 4.0 and, therefore, digital technologies, pose a new scenario in which most companies are naïve. This situation increases the uncertainty of companies regarding their perception of the pros and cons of implementing digital technologies. On the one hand, there is a wide range of technologies under the umbrella of Industry 4.0, which makes it problematic to assess which one would fit each company better. On the other hand, as it is difficult to foresee the future behavior of these technologies, most companies prefer to wait for others to act and observe their evolution. For the sake of generalization, different digital technologies are not presented. That pertains to each company, depending on the industry it develops its activity.

Sustainability has been a topic of great interest in the past and is still gathering companies' attention. This issue has demonstrated to be relevant to create competitive advantages and allow companies to remain profitable for a more extended period. This importance makes it attractive to combine with other hot topics, such as digital technologies.

Hence, this chapter aims to outline the main possibilities that digital technologies have to offer to companies to influence their sustainability at three levels (economic, environmental and social). It also aims to raise awareness of the importance of considering sustainability in any area of the company, even when there is skepticism on its effectiveness. This chapter is organized as follows: Section 2 illustrates the Fourth Industrial Revolution and how it is manifested at a global (intelligent supply chain) and company level (Industry 4.0). Section 3 presents the main arguments likening digital technologies and sustainability. Finally, Section 4 offers a discussion and the main conclusions.

2. THE FOURTH INDUSTRIAL REVOLUTION

2.1. Introduction

The essence of the Fourth Industrial Revolution is the digitalization of all physical assets and the integration into digital ecosystems with partners in the supply chain (Sanders et al., 2016, Zhong et al., 2017). The concept of Industry 4.0 mainly represents this revolution, which, in a general sense, describes the introduction of Internet technologies into the industry (Gabriel and Pessl, 2016). That is, it comprises the set of strategies and actions leading to the application of advanced information and communication systems and future-oriented technologies (Sanders et al., 2016) with the aim of bringing the virtual and

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